Dopaminergic differentiation using pluripotent stem cells.

Journal: J Cell Biochem

Publication Year: 2012

Authors: Olga Momcilovic, Justine Montoya-Sack, Xianmin Zeng

PubMed link: 22807388

Funding Grants: CIRM Research Training Program in Stem Cells and Aging

Public Summary:
Parkinson's disease (PD) is the second most common neurodegenerative disorder. The motor symptoms of PD are caused by the loss of dopaminergic (DA) neurons in the substantia nigra pars compacta of mesencephalon. The causes for death of DA neurons are not well understood, but the strongest risk factor is increasing age. There is no cure currently available for PD, and treatment is limited to management of PD symptoms in patients. Primary DA neurons are virtually unobtainable from living patients and animal studies have proven inadequate for studying the mechanism of PD development. Pluripotent stem cells (PSC) are primary self-renewing cells capable of differentiating into all cell types of an organism, including DA neurons. PSCs represent an abundant source of cells that can be genetically modified or isolated from patients with complex diseases, enabling the production of large quantities of DA neurons for disease modeling, drug screening, and gene function studies. Furthermore, since PD arises as a result of deterioration of DA neurons in a specific brain region, it has been suggested that a relatively small number of cells could restore normal function. PSCs could provide a source of DA neurons for cell replacement therapy. In this Prospects article, we focus on the development and in vitro derivation of DA neurons from PSCs, as well as current applications of the technological advances, with the emphasis on future directions and efforts in the field.

Scientific Abstract:
Parkinson's disease (PD) is the second most common neurodegenerative disorder. The motor symptoms of PD are caused by the loss of dopaminergic (DA) neurons in the substantia nigra pars compacta of mesencephalon. The causes for death of DA neurons are not well understood, but the strongest risk factor is increasing age. There is no cure currently available for PD, and treatment is limited to management of PD symptoms in patients. Primary DA neurons are virtually unobtainable from living patients and animal studies have proven inadequate for studying the mechanism of PD development. Pluripotent stem cells (PSC) are primary self-renewing cells capable of differentiating into all cell types of an organism, including DA neurons. PSCs represent an abundant source of cells that can be genetically modified or isolated from patients with complex diseases, enabling the production of large quantities of DA neurons for disease modeling, drug screening, and gene function studies. Furthermore, since PD arises as a result of deterioration of DA neurons in a specific brain region, it has been suggested that a relatively small number of cells could restore normal function. PSCs could provide a source of DA neurons for cell replacement therapy. In this Prospects article, we focus on the development and in vitro derivation of DA neurons from PSCs, as well as current applications of the technological advances, with the emphasis on future directions and efforts in the field.